Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Omicron SARS-CoV-2 variant: Reasons of emergence and lessons learnt

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Dear Editor,

Coronavirus disease 2019 (COVID-19), caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has resulted in a catastrophic pandemic [1]. Since the COVID-19 pandemic began, several SARS-CoV-2 mutants or variants have been discovered and reported. These variants are usually the products of recombination, selection pressure, and point mutations. The neutralizing activity of vaccine-elicited antibodies and monoclonal antibodies (MABs) could be affected by SARS-CoV-2 mutations, resulting in a mild-to-significant loss of efficacy. Moreover, these viral mutations might considerably affect the viral transmission, treatment effectiveness, and diagnostic procedures. Recently, the emergence of the Omicron variant (B.1.1.529) of SARS-CoV-2 has been postulated to be a serious threat which can worsen the prevailing situation amid the serious efforts of many nations to contain this global pandemic [2]. This correspondence article aims to highlight the plausible reasons which could have led to the emergence of the Omicron variant (B.1.1.529) and the lessons learnt which could avert such viral evolutions in the future.

Initially, the Omicron variant was detected in Botswana, South Africa. On November 24, 2021, it was reported to the World Health Organization (WHO), and on November 26, 2021, it was identified as a variant of concern (VOC) (WHO, https://www.who.int/news/item/26-11-2021-classification-of-omicron-(B.1.1.529)-sars-cov-2-variant-of-concern). Moreover, according to the latest available statistics from the GISAID COVID tracking programme as of December 7, 2021, 697 Omicron cases have been confirmed worldwide. Out of all the confirmed cases, 228 have been found in South Africa, 33 in Ghana, and 33 in the United States. In addition, 42 countries have confirmed the presence of this newly evolved variant (GISAID, https://www.gisaid.org/hcov19-variants/). However, the actual figures may be higher than the recorded numbers and these numbers might increase drastically in the coming weeks.

Of note, the scientific community across the globe has raised concerns about the emergence of the Omicron variant due to the large number of mutations as compared to the previously reported VOCs. A total of 32 mutations have been detected in the spike protein alone compared to the 16 mutations in the highly infectious Delta variant (B.1.617.2), besides those in other proteins such as NSP12 and NSP14 that are essential for viral replication. Moreover, it is believed that the Omicron variant could be three times more infectious than the original SARS-CoV-2 strain [2] (Fig. 1). The recent early research has indicated that the Omicron variant contains certain deletions as well as a significant number of mutations, some of which overlap with those found in the Alpha, Beta, Gamma, and Delta VoCs. Such kind of deletions and mutations have been well-known for increasing viral transmissibility and binding affinity. Moreover, these mutations have been postulated to have higher chances of immune evasion or antibody escape. Although the consequences of the other omicron mutations have not been deciphered yet, there is a great degree of ambiguity regarding how the whole combination may alter the viral behaviour and vulnerability to both natural and vaccine-induced immunity [3].

Early evidence has shown that the Omicron (B.1.1.529) and the Alpha (B.1.1.7) variant share a mutation known as P681H, which, when paired with two other modifications, may enable the virus to spread more easily from person to person. Another investigation has suggested that the combination of the two additional alterations, Q498R and N501Y, might enhance the virus's ability to bind to the host receptor Angiotensin-converting enzyme 2 (ACE2). A section of the spike known as the N-terminal domain also has some missing amino acids. This area of the spike is a popular target for neutralizing antibodies (NABs), the immunological proteins that prevent the virus from entering into the cells. Notable changes in the target area of the NABs could enable the virus to evade the immune response elicited from the natural infection or vaccination. (ScienceNews, https://www.sciencenews.org/article/omicron-coronavirus-variant-vaccines-mutations). In this context, the transmission of the Omicron variant between two fully vaccinated persons across the corridor of a quarantined hotel has highlighted the potential concern associated with the Omicron variant [4]. However, it is evident that it would be an ambiguity for certain weeks whether the Omicron is also capable of evading the vaccine-induced immunity.

Since the emergence of the Omicron form, several countries have

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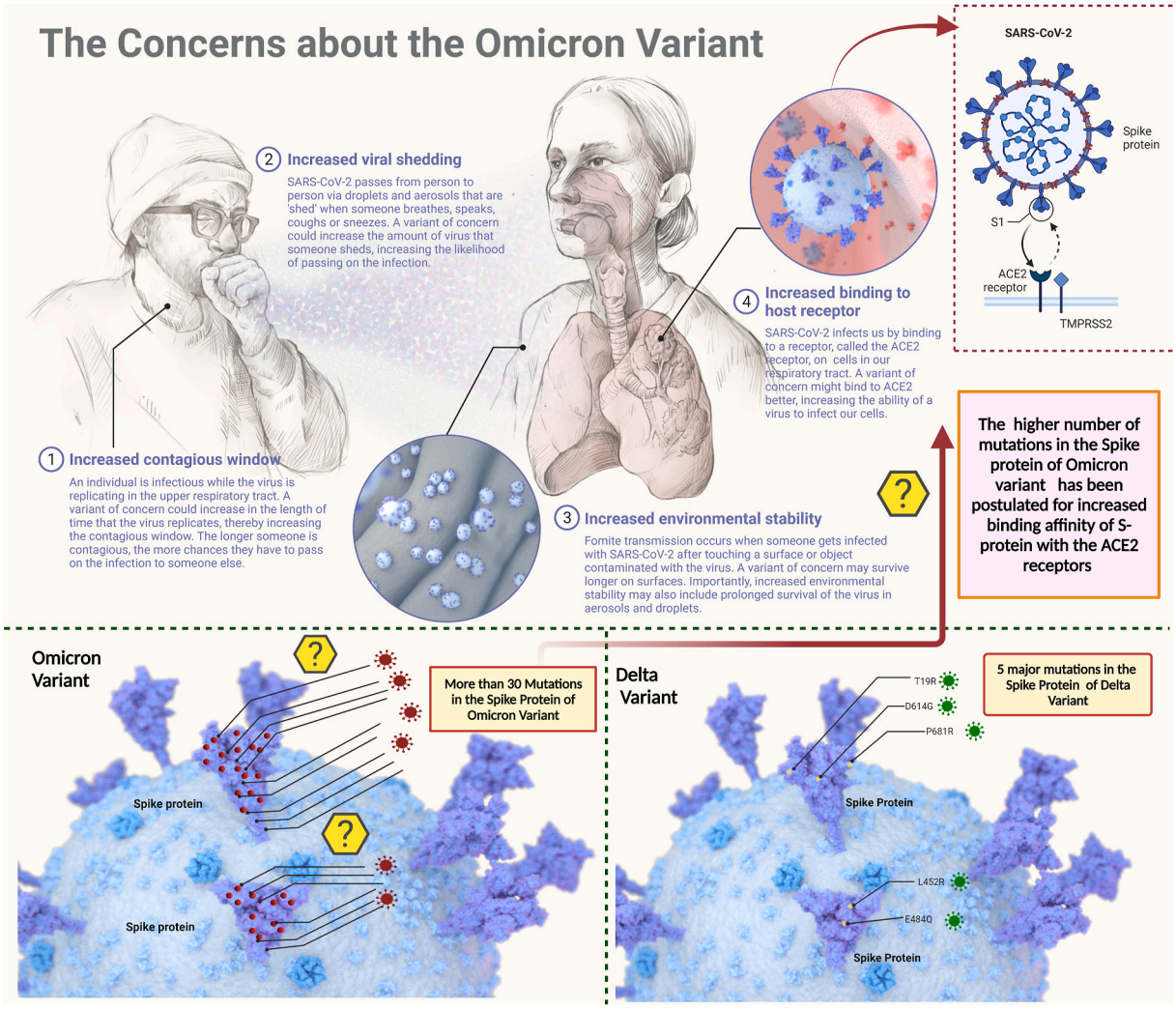

Fig. 1. The figure (adapted from www.biorender.com) represents the comparative number of mutations observed in the most dominating variant of the time delta variant and the newly emerged Omicron variant and the potential concerns associated with the emergence of Omicron variant. Moreover, large number of mutations in the Omicron variant can be associated with the increased capability of transmission and the binding affinity with angiotensin converting enzyme 2 (ACE2) receptors to gain access into the host cells. However, there are still several questions marks regarding the concerns related with the Omicron variant such as the actual increase in the transmissibility and virulence which will be addressed in future.

made significant adjustments in their immunization programmes, including the recommendation for a third booster dose of vaccine in large populations to avoid any potential repercussions. According to Keeling and his co-authors' modelling study, COVID-19 hospitalization rates in England can be reduced with the boosters and kept below the present levels for at least two years. However, if the protection wears off faster than expected, the boosters may be required every 6–12 months to avoid an increase in hospital admissions and fatalities [5].

It is necessary to keep in mind that providing immunizations to those who have not had a single dose is more vital than the implementation of booster protocols. This unvaccinated mass includes the vast majority of people in Africa, whose vaccination rates are far lower than in other regions of the world, thus favouring the emergence of variants. For months, scientists have cautioned that disparities in the vaccine distribution might promote the viral evolution and spread by exposing huge groups of individuals to infection (ScienceNews, https://www.sciencenews.org/article/omicron-coronavirus-variant-vaccines-mutations). Inequalities in the vaccination rates across the countries would not let the pandemic halt, as countries with low vaccination rates are likely to develop variants. In addition to the use of boosters, the emergence of the Omicron variant necessitates an international travel prohibition to avoid any catastrophic repercussions. It is well-known that a travel ban can buy some additional time to mitigate the disastrous consequences of the outbreak of a novel variant. Moreover, while the vaccination programmes, including the boosters are still in full swing in many countries, the effective border-control measures are also required. A strict implementation of travel restrictions along with an efficient track and trace system is required to provide enough time to the healthcare system to prepare for any potential overburdening due to the rise of cases (Nature News, https://doi.org/10.1038/d41586-021-03608-x).

Furthermore, the novel variants of SARS-CoV-2 have been detected on a regular basis. Many immunocompromised people, with their weakened immune systems and higher susceptibility to infection due to a lack of adequate public health infrastructure, lower vaccination rates, and other factors, facilitate the emergence and dissemination of novel viral variants. Thus, there is a need for the worldwide coordinated efforts by the government agencies, biotechnology and pharmaceutical companies as well as the research and healthcare institutions, in order to effectively manage this pandemic. It has been well stated by one of the WHO scientists that by delaying action to address the vaccination disparity, we are giving more time to the virus to evolve in a manner that scientists may not be able to anticipate or control. Hence, it is necessary to adopt the public health and social measures in a targeted and consistent manner to eradicate this pandemic (https://www.sciencen

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Author contribution

Manish Dhawan: Conceptualization, Data Curation, Visualization, Writing - Original Draft, Writing - review & editing. **Priyanka:** Conceptualization, Writing - Original Draft, Writing - review & editing. **Om Prakash Choudhary**: Supervision, Writing - Original Draft, Writing - review & editing. All authors critically reviewed and approved the final version of the manuscript.

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Om Prakash Choudhary, Assistant Professor, Department of Veterinary Anatomy and Histology, College of Veterinary Sciences and Animal Husbandry, Central Agricultural University (I), Selesih, Aizawl-796015, Mizoram, India. Tel: +91–9928099090; Email: dr.om.choudhary@gmail.com.

Data statement

The data in this correspondence article is not sensitive in nature and is accessible in the public domain. The data is therefore available and not of a confidential nature.

Declaration of competing interest

All authors report no conflicts of interest relevant to this article.

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References

[1] O.P. Choudhary, Priyanka, T.A. Mohammed, I. Singh, Intranasal COVID-19 vaccines: is it a boon or bane? Int. J. Surg. 94 (2021) 106119, https://doi.org/10.1016/j.ijsu.2021.106119.
[2] S.J. Gao, H. Guo, G. Luo, Omicron variant (B.1.1.529) of SARS-CoV-2, a global urgent public health alert, J. Med. Virol. (2021), https://doi.org/10.1002/jmv.27491.
[3] S.S.A. Karim, Q.A. Karim, Omicron SARS-CoV-2 variant: a new chapter in the COVID-19 pandemic, Lancet (2021), https://doi.org/10.1016/S0140-6736(21)02758-6.
[4] H. Gu, P. Krishnan, D.Y.M. Ng, L.D.J. Chang, G.Y.Z. Liu, S.S.M. Cheng, M.M.Y. Hui, M.C.Y. Fan, J.H.L. Wan, L.H.K. Lau, B.J. Cowling, M. Peiris, L.L.M. Poon, Probable transmission of SARS-CoV-2 Omicron variant in quarantine hotel, Hong Kong, China, Emerg. Infect. Dis. 28 (2) (2021), https://doi.org/10.3201/eid2802.212422.
[5] N. Andrews, J. Stowe, F. Kirsebom, C. Gower, M. Ramsay, J.L. Bernal, Effectiveness of BNT162b2 (Comirnaty, Pfizer-BioNTech) COVID-19 booster vaccine against covid-19 related symptoms in England: test negative case-control study, medRxiv (2021), https://doi.org/10.1101/2021.11.15.21266341, 2021.11.15.21266341.

Manish Dhawan
Department of Microbiology, Punjab Agricultural University, Ludhiana, 141004, Punjab, India
The Trafford Group of Colleges, Manchester, WA14 5PQ, UK

Priyanka
Independent Researcher, 07, Type IV Quarter, College of Veterinary Sciences and Animal Husbandry, Central Agricultural University (I), Selesih, Aizawl, 796015, Mizoram, India

Om Prakash Choudhary*
Department of Veterinary Anatomy and Histology, College of Veterinary Sciences and Animal Husbandry, Central Agricultural University (I), Selesih, Aizawl, 796015, Mizoram, India

* Corresponding author. Department of Veterinary Anatomy and Histology, College of Veterinary Sciences and Animal Husbandry, Central Agricultural University (I), Selesih, Aizawl, 796015, Mizoram, India.
E-mail address: dr.om.choudhary@gmail.com (O.P. Choudhary).